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<p>(54) Title: SULFINYL AND SULFONYL SUBSTITUTED 3-BENZAZEPINES</p> <p>(57) Abstract</p> <p>Sulfinyl and sulfonyl substituted 3-benzazepine compounds are useful in treating and preventing emesis. Particular compounds of this invention are 7-methyl-sulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine and 8-methoxy-7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine.</p>		

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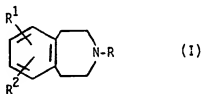
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## SULFINYL AND SULFONYL SUBSTITUTED 3-BENZAZEPINES

This invention relates to sulfinyl and sulfonyl substituted benzazepine compounds for use in treating emesis.

These compounds are known in the art and may be prepared as shown in European Patent Application 86309846.3. They have been reported as having utility in the treatment of gastrointestinal diseases. It has now been found that the sulfinyl and sulfonyl substituted benzazepine compounds are useful therapeutically for treating or preventing emesis.

According to the present invention there is provided the use of a compound of the formula (I):



in which:

R is hydrogen, C<sub>1</sub>-C<sub>6</sub>alkyl or C<sub>3</sub>-C<sub>5</sub>alkenyl;

R<sup>1</sup> is SO<sub>2</sub>R<sup>3</sup>, SO<sub>2</sub>R<sup>3</sup> or SO<sub>2</sub>NR<sup>4</sup>R<sup>5</sup>;

R<sup>2</sup> is hydrogen, halogen, CF<sub>3</sub>, C<sub>1</sub>-C<sub>6</sub>alkyl or R<sup>6</sup>O-;

R<sup>3</sup> is C<sub>1</sub>-C<sub>6</sub>alkyl or CF<sub>3</sub>;

R<sup>4</sup> and R<sup>5</sup> are hydrogen or C<sub>1</sub>-C<sub>6</sub>alkyl; and

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1           R<sup>6</sup> is hydrogen, C<sub>1</sub>-C<sub>6</sub>alkyl or C<sub>1</sub>-C<sub>6</sub>alkanoyl,  
provided that when R<sup>1</sup> is SO<sub>2</sub>NH<sub>2</sub>, R<sup>2</sup> is R<sup>6</sup>O-, halogen,  
CF<sub>3</sub> or C<sub>1</sub>-C<sub>6</sub>alkyl,  
5       or a pharmaceutically acceptable acid addition salt  
thereof in the manufacture of a medicament for treating or  
preventing emesis.

Particular compounds of formula (I) are those  
in which R<sup>1</sup> is in the 7-position. Further particular  
10       compounds of formula (I) are those in which R<sup>1</sup> is in the  
7-position and R<sup>2</sup> is in the 8-position.

A group of compounds of formula (I) is that in  
which R<sup>1</sup> is SO<sub>2</sub>R<sup>3</sup> or SO<sub>2</sub>NR<sup>4</sup>R<sup>5</sup>, R<sup>2</sup> is hydrogen, alkoxy or  
hydroxy, R<sup>3</sup> is methyl and R is hydrogen and, in addition,  
15       R<sup>1</sup> may be in the 7-position and R<sup>2</sup> may be in the  
8-position.

Specific compounds of this invention are:

8-hydroxy-7-methylsulfonyl-2,3,4,5-tetrahydro-  
1H-3-benzazepine;  
20       7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine;  
8-hydroxy-7-(N-methylsulfamoyl)-2,3,4,5-tetra-  
hydro-1H-3-benzazepine;  
25       8-methoxy-7-methylsulfonyl-2,3,4,5-tetrahydro-1H-  
3-benzazepine;  
6-sulfamoyl-2,3,4,5-tetrahydro-1H-3-benzazepine;  
7-sulfamoyl-2,3,4,5-tetrahydro-1H-3-benzazepine.

The compounds of formula (I) form pharmaceuti-  
cally acceptable acid addition salts with organic or  
30       inorganic acids. Examples of these acids are  
hydrochloric, hydrobromic, sulfuric, phosphoric, acetic,  
tartaric, citric, maleic, lactic, oxalic, succinic,  
methanesulfonic, and benzenesulfonic acids. The salts are  
formed according to methods known to the art. If the  
35       product is isolated as an acid addition salt, it may be  
treated with an inorganic or organic base, such as aqueous  
sodium hydroxide, sodium carbonate, triethylamine, etc.,

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1 and converted to the corresponding free base. The base  
can then be treated with an appropriate acid, for example  
in an aqueous miscible solvent, such as a lower alkanol  
preferably methanol or ethanol, to give the desired salt.

5 The effect of the pharmacologically active  
compounds of this invention on emesis is demonstrated in  
the following test procedure.

Method for Determination of the Anti-emetic Effect in the  
Conscious Dog

10 Compounds are administered orally or parenterally  
to proven apomorphine-sensitive dogs of either sex. After  
the appropriate time has elapsed (determined by a peak  
time study), apomorphine hydrochloride (0.1 mg/kg, s.c.)  
is administered and the frequency of emesis is observed  
15 and recorded for the next forty minutes. Emesis is  
defined as the actual expulsion of stomach contents.

The control group of dogs, also apomorphine-  
sensitive, receive the test vehicle and apomorphine  
hydrochloride (0.1 mg/kg, s.c.) Emesis is recorded as  
20 with the test animals.

The mean frequency of emesis for the control and  
test groups is calculated. A value for each test group is  
then obtained which expresses the percentage increase or  
decrease in frequency of emesis relative to controls. An  
25 effective dose-50% is calculated. The ED<sub>50</sub> refers to  
the dose that decreases emesis induced by apomorphine by  
50%.

The pharmacologically active compounds of  
formula (I) can be administered orally or parenterally.  
30 Preferably, these compounds are administered in conven-  
tional dosage unit forms prepared by combining an appro-  
priate dose of the compound with standard pharmaceutical  
carriers. The dosage units will contain the active  
ingredient in an effective amount selected from about 1 mg.  
35 to about 250 mg., preferably 10 mg. to 100 mg.

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1           The pharmaceutical carrier employed may be, for  
example, either a solid or liquid. Exemplary of solid  
carriers are lactose, terra alba, sucrose, talc, gelatin,  
5   agar, pectin, acacia, magnesium stearate, stearic acid and  
the like. Exemplary of liquid carriers are syrup, peanut  
oil, olive oil, water and the like. Similarly, the carrier  
or diluent can include any time delay material well known  
to the art, such as glyceryl monostearate or glyceryl  
10   distearate alone or with a wax.

A wide variety of pharmaceutical forms can be  
employed. Thus, if a solid carrier is used the prepara-  
tion can be tableted, placed in a hard gelatin capsule in  
powder or pellet form or in the form of a trousse or  
15   lozenge. The amount of solid carrier will vary widely but  
preferably will be from about 25 mg. to about 1 g. If a  
liquid carrier is used, the preparation will be in the  
form of a syrup, emulsion, soft gelatin capsule, sterile  
injectable liquid such as an ampul or an aqueous or  
20   nonaqueous liquid suspension.

The pharmaceutical compositions are prepared by  
conventional techniques involving procedures such as  
mixing, granulating and compressing when necessary or  
variously mixing and dissolving the ingredients as appro-  
25   priate to the desired composition.

The method of treating and preventing emesis in  
accordance with this invention comprises administering  
internally to a subject in need of said treatment an  
effective amount of a compound of formula (I), in  
30   particular, 7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine, 5-sulfamoyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine, 7-sulfamoyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine, or 8-methoxy-7-methylsulfonyl-2,3,4,5-tetra-  
hydro-1H-3-benzazepine or a pharmaceutically acceptable  
35   acid addition salt thereof.

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1           The compound will preferably be administered in a  
dosage unit form orally or parenterally. Advantageously  
equal doses will be administered one to four times daily  
with the daily dosage regimen being from about 1 mg. to  
about 1000 mg., preferably from 10 mg. to 400 mg.

One skilled in the art will recognize that in  
determining the amounts of the compound needed to produce  
the desired pharmacological effect without toxic side  
effects, the activity of the particular compound as well  
as the size of the host animal must be considered.

The following examples illustrate the invention  
but are not to be construed as limiting the scope  
thereof. Temperatures are in degrees Centigrade unless  
otherwise stated.

#### EXAMPLE 1

##### 8-Hydroxy-7-sulfamoyl-2,3,4,5-tetrahydro-1H-3-benzazepine.

A mixture of 3-methoxyphenylacetic acid (47.7 g,  
0.287 m), thionyl chloride (50 ml) and N,N-dimethylforma-  
mide (6 drops) in toluene (500 ml) was stirred for 16  
hours at 25° and concentrated in vacuo to afford 3-methoxy-  
phenylacetyl chloride. The acetyl chloride was dissolved  
in chloroform (100 ml) and added to a solution of amino-  
acetaldehyde dimethyl acetal (32.1 g, 0.306 m) and tri-  
ethylamine (32.4 g, 0.320 m) in chloroform (500 ml) stirred  
at 5°. The mixture was stirred at 25° for 16 hours, washed  
with water, 1.5N hydrochloric acid and water, dried with  
magnesium sulfate and concentrated in vacuo to give  
N-(2,2-dimethoxyethyl)-3-methoxybenzeneacetamide.

A solution of the benzeneacetamide (70 g,  
0.277 m) in acetic acid (180 ml) was added with stirring  
to concentrated hydrochloric acid (120 ml). The mixture  
was stirred for 16 hours, diluted with ice/water and  
filtered. The filter cake was dissolved in methylene  
chloride which was washed with water, dried with magnesium  
sulfate and concentrated in vacuo to give 2,3-dihydro-8-  
methoxy-2-oxo-1H-3-benzazepine.

1 A mixture of 2,3-dihydro-8-methoxy-2-oxo-1H-  
3-benzazepine (12 g, 0.063 m) and 10% palladium-on-carbon  
(1.2 g) in acetic acid (200 ml) was shaken in an atmos-  
5 phere of hydrogen (60 psi), degassed, filtered and  
concentrated in vacuo. The residue was dissolved in  
methylene chloride, washed with water, dried with magnesium  
sulfate and concentrated in vacuo. The residue was  
triturated with ether and filtered to give 8-methoxy-  
10 2-oxo-2,3,4,5-tetrahydro-1H-3-benzazepine.

A suspension of 8-methoxy-2-oxo-2,3,4,5-tetra-  
hydro-1H-3-benzazepine (20.4 g, 0.105 m) in tetrahydrofuran  
(500 ml) was added to 1M borane in tetrahydrofuran (300  
ml) stirred at 5°. The mixture was heated to reflux for 2  
15 hours, cooled, treated with 3N hydrochloric acid (300 ml),  
concentrated in vacuo to remove tetrahydrofuran and heated  
to reflux for 1 hour. The mixture was concentrated in  
vacuo, filtered and the filter cake was dissolved in  
methanol, heated to reflux, dried with magnesium sulfate  
20 and concentrated in vacuo to afford 7-methoxy-2,3,4,5-  
tetrahydro-1H-3-benzazepine hydrochloride, m.p. 229-231°.

A mixture of 7-methoxy-2,3,4,5-tetrahydro-  
1H-3-benzazepine hydrochloride (4.3 g, 0.02 m) and sodium  
acetate (3.3 g, 0.04 m) in acetic anhydride (13 ml) was  
25 refluxed and stirred for 16 hours, concentrated in vacuo  
and partitioned between methylene chloride and water. The  
organic phase was dried with magnesium sulfate, filtered  
and concentrated in vacuo to give 3-acetyl-7-methoxy-  
2,3,4,5-tetrahydro-1H-3-benzazepine, m.p. 89-90°.

3-Acetyl-7-methoxy-2,3,4,5-tetrahydro-1H-  
30 3-benzazepine (2.3 g, 0.01 m) was added to chlorosulfonic  
acid (6 ml) which was stirred at 0°; the mixture was  
allowed to warm to 25° and stirred for 16 hours. The  
reaction was carefully poured into ice water and extracted  
with methylene chloride. The methylene chloride extracts  
35 were combined, washed, dried with magnesium sulfate and  
concentrated in vacuo to give 3-acetyl-7-chlorosulfonyl-8-  
methoxy-2,3,4,5-tetrahydro-1H-3-benzazepine, m.p. 153-160°.



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1           3-Acetyl-7-chlorosulfonyl-8-methoxy-2,3,4,5-  
tetrahydro-1H-3-benzazepine (3 g, 0.007 m) was treated  
with concentrated ammonium hydroxide (10 ml), stirred for  
2 hours and filtered to give 3-acetyl-8-methoxy-7-sulfa-  
5       moyl-2,3,4,5-tetrahydro-1H-3-benzazepine, m.p. 260-263°.

The sulfonamide (2.3 g, 0.007 m) was suspended in  
3N hydrochloric acid and heated to reflux for 16 hours.  
The mixture was concentrated in vacuo and the residue  
crystallized from methanol to give 8-methoxy-7-sulfamoyl-  
10       2,3,4,5-tetrahydro-1H-3-benzazepine hydrochloride, m.p.  
270-274°.

8-Methoxy-7-sulfamoyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine hydrochloride (1.5 g, 0.005 m) was dissolved  
in 48% hydrobromic acid (15 ml), refluxed for 2 hours and  
concentrated in vacuo. The residue was triturated with  
acetone and then recrystallized from methanol to give  
8-hydroxy-7-sulfamoyl-2,3,4,5-tetrahydro-1H-3-benzazepine  
hydrobromide, m.p. 315-320° (decomp.).

#### EXAMPLE 2

20       8-Hydroxy-7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine.

##### Method A

3-Acetyl-7-chlorosulfonyl-8-methoxy-2,3,4,5-tetra-  
25       hydro-1H-3-benzazepine (18 g, 0.056 m) was added in  
portions to a mixture of sodium sulfite (8.8 g, 0.069 m)  
and sodium bicarbonate (10.8 g, 0.115 m) in water (36 ml)  
stirred at 70°C. There was a vigorous evolution of gas  
after each addition. The mixture was stirred for fifteen  
30       minutes, treated with iodomethane (8.5 ml, 0.136 m) and  
refluxed for forty-five minutes. The mixture was parti-  
tioned between methylene chloride and water. The methylene  
chloride phase was washed with water, dried with sodium  
sulfate and concentrated in vacuo to give 3-acetyl-8-  
35       methoxy-7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-benzaze-  
pine, m.p. 159-162°C.

1     Method B

3-Acetyl-7-chlorosulfonyl-8-methoxy-2,3,4,5-  
tetrahydro-1H-3-benzazepine (4 g, 0.013 m) was dissolved  
in glacial acetic acid (80 ml), treated with stannous  
chloride dihydrate (11.6 g, 0.05 m) and concentrated  
hydrochloric acid (16 ml) and stirred at 75° for 1 hour.  
The mixture was cooled, poured into ice water and extract-  
ed with ethyl acetate. The combined ethyl acetate extract  
was washed, dried with magnesium sulfate and concentrated  
in vacuo to give a mixture of 3-acetyl-7-mercapto-8-  
methoxy-2,3,4,5-tetrahydro-1H-3-benzazepine and the  
corresponding disulfide.

The crude mixture (3 g) was dissolved in ethanol  
and treated with sodium borohydride (2 g, 0.05 m) to  
effect reduction of the disulfide to the mercaptan.  
Methyl iodide (2 g, 0.014 m) was added and the reaction  
mixture was stirred at 25° for 1 hour. The mixture was  
concentrated, partitioned between water and methylene  
chloride and the combined methylene chloride extract was  
washed, dried with magnesium sulfate and concentrated in  
vacuo to give 3-acetyl-8-methoxy-7-methylthio-2,3,4,5-  
tetrahydro-1H-3-benzazepine, m.p. 138-140°.

3-Acetyl-8-methoxy-7-methylthio-2,3,4,5-tetra-  
hydro-1H-3-benzazepine (1.1 g, 0.004 m) dissolved in  
methylene chloride (10 ml) was treated with 3-chloro-  
perbenzoic acid (1.4 g, 0.008 m) and stirred for 1 hour.  
The mixture was extracted with 5% aqueous sodium carbonate,  
washed with water, dried with magnesium sulfate and  
concentrated in vacuo to give 3-acetyl-8-methoxy-7-methyl-  
sulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine, m.p. 162-164°.

3-Acetyl-8-methoxy-7-methylsulfonyl-2,3,4,5-  
tetrahydro-1H-3-benzazepine (1 g, 0.003 m), prepared as in  
Method A or B, in 48% hydrobromic acid (15 ml) was heated  
to reflux for 16 hours and concentrated in vacuo. The  
residue was triturated with acetone and recrystallized  
from methanol-water to give 8-hydroxy-7-methylsulfonyl-

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1 2,3,4,5-tetrahydro-1H-3-benzazepine hydrobromide, m.p.  
300° (decomp.).

4 Alternatively, 3-acetyl-8-methoxy-7-methyl-  
5 sulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine was treated  
with 3N hydrochloric acid to give 8-methoxy-7-methyl-  
sulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine hydrochloride,  
m.p. 228.5-229.5°. Refluxing this compound with 48%  
hydrobromic acid gave 8-hydroxy-7-methylsulfonyl-2,3,4,5-  
10 tetrahydro-1H-3-benzazepine hydrobromide.

EXAMPLE 3

7-Methylsulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine.

Following the procedure of Examples 1 and 2,  
2,3,4,5-tetrahydro-1H-3-benzazepine was converted to  
3-acetyl-7-chlorosulfonyl-2,3,4,5-tetrahydro-1H-3-benza-  
15 zepine and then to 3-acetyl-7-methylsulfonyl-2,3,4,5-tetra-  
hydro-1H-3-benzazepine which was hydrolyzed with hydro-  
chloric acid to give 7-methylsulfonyl-2,3,4,5-tetrahydro-  
1H-3-benzazepine hydrochloride, m.p. 275-277°C.

EXAMPLE 4

20 7-Methylsulfonyl-2,3,4,5-tetrahydro-1H-3-  
benzazepine methanesulfonate (10 mg) is mixed with 75 mg  
of lactose and 2 mg of magnesium stearate. The resulting  
mixture is filled into a hard gelatin capsule.

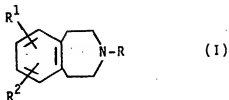
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## 1 CLAIMS:

1. The use of a compound of the formula:



in which:

R is hydrogen, C<sub>1</sub>-C<sub>6</sub>alkyl or C<sub>3</sub>-C<sub>5</sub>alkenyl;  
 R<sup>1</sup> is SO<sub>2</sub>R<sup>3</sup>, SO<sub>2</sub>R<sup>3</sup> or SO<sub>2</sub>NR<sup>4</sup>R<sup>5</sup>;  
 R<sup>2</sup> is hydrogen, halogen, CF<sub>3</sub>, C<sub>1</sub>-C<sub>6</sub>alkyl or R<sup>6</sup>O-;  
 R<sup>3</sup> is C<sub>1</sub>-C<sub>6</sub>alkyl or trifluoromethyl;  
 R<sup>4</sup> and R<sup>5</sup> are hydrogen or C<sub>1</sub>-C<sub>6</sub>alkyl; and  
 R<sup>6</sup> is hydrogen, C<sub>1</sub>-C<sub>6</sub>alkyl or C<sub>1</sub>-C<sub>6</sub>alkanoyl,  
 provided that when R<sup>1</sup> is SO<sub>2</sub>NH<sub>2</sub>, R<sup>2</sup> is R<sup>6</sup>O-,  
 halogen, CF<sub>3</sub> or C<sub>1</sub>-C<sub>6</sub>alkyl,

or a pharmaceutically acceptable acid addition salt thereof, in the manufacture of a medicament for treating or preventing emesis.

2. The use of a compound as defined in claim 1 in which R<sup>1</sup> is in the 7-position.

3. The use of a compound as defined in claim 1 in which R<sup>2</sup> is in the 8-position and R<sup>1</sup> is in the 7-position.

4. The use of a compound as defined in claim 1 in which R<sup>1</sup> is SO<sub>2</sub>R<sup>3</sup> or SO<sub>2</sub>NR<sup>4</sup>R<sup>5</sup>, R<sup>2</sup> is hydrogen or C<sub>1</sub>-C<sub>6</sub>alkoxy, R<sup>3</sup> is methyl, R is hydrogen, R<sup>2</sup> is in the 8-position and R<sup>1</sup> is in the 7-position.

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5. The use of a compound as defined in claim 1 said compound being 7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine.

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6. The use of a compound as defined in claim 1 said compound being 8-methoxy-7-methylsulfonyl-2,3,4,5-tetrahydro-1H-3-benzazepine.

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# INTERNATIONAL SEARCH REPORT

International Application **NPT/US88/01169**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC(4): <b>A61K 31/55</b>		
U.S.Cl.: <b>514/213</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
U.S.	514/213	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>CAS ON LINE</b>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>1</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	U.S., A, 3,689,649 (DIETRICH) published 05 September 1972. See entire document.	I-13
A	U.S., A, 4,024,128 (KOCH) published 17 May 1977. See entire document.	I-13
<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
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